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NATIONAL DAM SAFETY PROGRAM. SELLENRIEK DAM (MO 31048), OSAGE-G--ETC(U)

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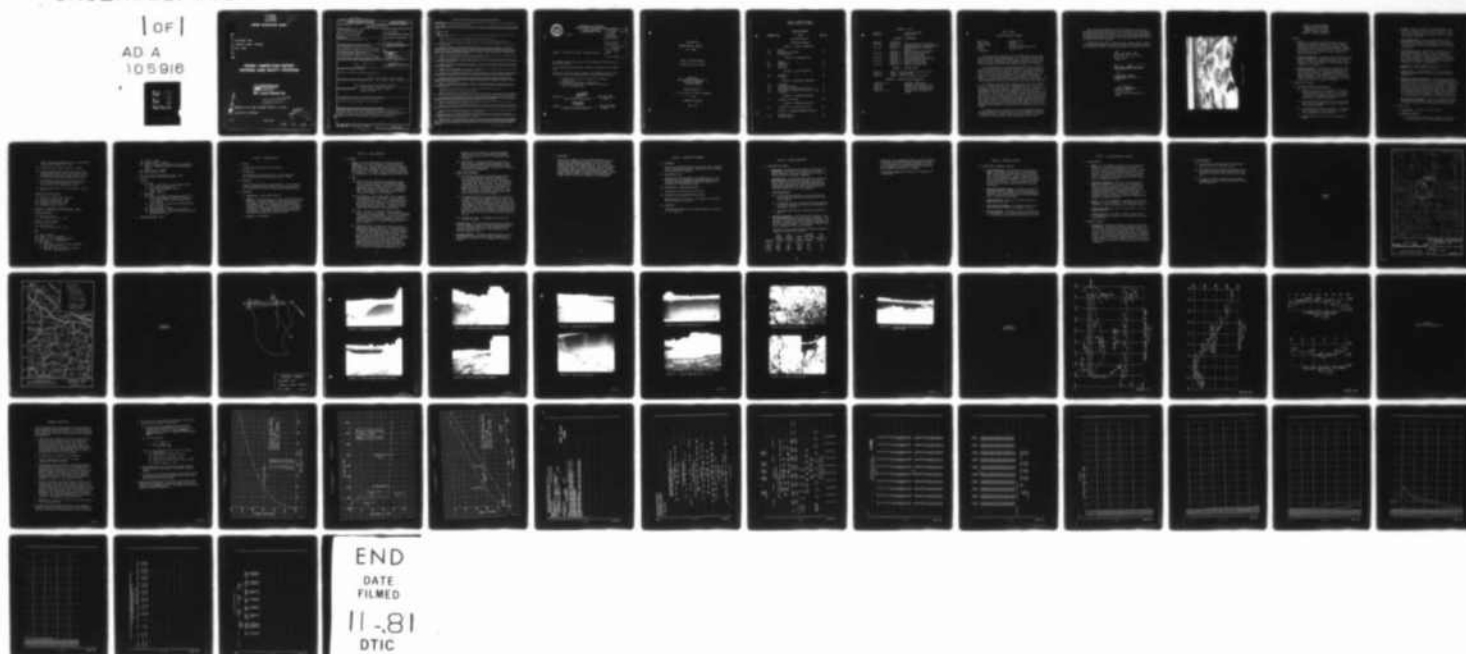
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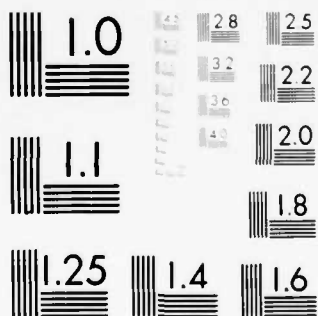
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SELLENRIEK DAM

FRANKLIN COUNTY, MISSOURI

MO. 31048

**PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM**



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St. Louis District

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SUBJECT: Sellenriek Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Sellenriek Dam:

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

- 1) Spillway will not pass 50 percent of the Probable Maximum Flood.
- 2) Overtopping could result in dam failure..
- 3) Dam failure significantly increases the hazard to loss of life downstream.

SIGNED

SUBMITTED BY: Chief, Engineering Division

21 SEP 1979
Date

SIGNED

APPROVED: Colonel, CE, District Engineer

21 SEP 1979
Date

SELLENRIEK DAM
FRANKLIN COUNTY, MISSOURI
MO. 31048

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
HOSKINS-WESTERN-SONDEREGGER, INC.
CONSULTING ENGINEERS
LINCOLN, NEBRASKA

UNDER DIRECTION OF
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
FOR
GOVERNOR OF MISSOURI

JUNE, 1979

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam	Sellenriek Dam
State Located	Missouri
County Located	Franklin County
Stream	Tributary to Big Berger Creek
Date of Inspection	June 27, 1979

Sellenriek Dam was inspected by an interdisciplinary team of engineers from Hoskins-Western-Sonderegger, Inc. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers, and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as a small size dam with a high downstream hazard potential. Failure would threaten life and property. The estimated damage zone extends approximately three miles downstream of the dam. Within the damage zone are three or more dwellings and associated structures.

Our inspection and evaluation indicates that the spillway does not meet the criteria set forth in the recommended guidelines for a small dam having a high hazard potential. Considering the small volume of water impounded and the large floodplain downstream of the dam, one-half of the Probable Maximum Flood is the appropriate spillway design flood. The spillways will not pass 50% of the probable maximum flood without overtopping the dam. The spillways will pass the 100-year flood (flood having a one percent chance of being exceeded in any year) without overtopping the dam. The spillways will pass 40% of the Probable Maximum Flood without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

No design data were available for this dam. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These analyses should be obtained in the future.

Other deficiencies observed during the inspection are small trees and brush growing along the water line, considerable erosion of upstream face, muskrat burrows along the water line, a few small cedar trees growing on the downstream slope, scour hole at end of principal spillway outlet is overgrown with brambles and brush and the channel downstream from the dam is overgrown with trees and brush.

Maintenance of this dam is generally good. Several items of preventive maintenance addressed to the minor deficiencies listed above need to be initiated by the owner. These are described in the body of the report.



Rey S. Decker
E-3703



Gordon Jamison



Garold Ulmer
E-4777



Harold P. Hoskins
Chairman of Board
Hoskins-Western-Sonderegger, Inc.
E-8696



PHOTO NO. 1 - OVERVIEW

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SELLENRIEK DAM - MO 31048
FRANKLIN COUNTY, MISSOURI
SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

- a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of Sellenriek Dam be made.
- b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.
- c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams," Appendix D to "Report of the Chief of Engineers on the National Program of Inspection of Dams," dated May, 1975, and published by the Department of the Army, Office of the Chief of Engineers.

1.2 DESCRIPTION OF PROJECT

- a. Description of Dam and Appurtenances.
 - (1) The dam is an earth fill approximately 730 feet in length and about 32 feet in height. It is located in rolling hills covered with a loess soil mantle 5 to 10 feet in thickness overlying limestone and residual soils derived from limestone.
 - (2) The principal spillway consists of a 12 inch welded steel pipe with a hooded inlet passing through the base of the embankment.
 - (3) A vegetated earth emergency spillway is cut through the left abutment. It is trapezoidal in section with a bottom width of about 20 feet.
 - (4) Pertinent physical data are given in paragraph 1.3 below.

- b. Location. The dam is located in the northwestern corner of Franklin County, Missouri, as shown on Plate A-2. The dam is shown on Plate A-1 in the NE $\frac{1}{4}$ of Section 11, T44N, R4W. The lake formed behind the dam is shown in the NE $\frac{1}{4}$ of Section 11, T44N, R4W.
- c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, this dam and impoundment is in the small size category.
- d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph c above. Based on referenced guidelines, this dam is in the High Hazard Classification. The estimated damage zone extends approximately three miles downstream where three or more dwellings with associated structures are located in the floodplain.
- e. Ownership. The dam is owned by Mrs. Helen Sellenriek, 849 White Road, Chesterfield, Mo. 63017.
- f. Purpose of Dam. The dam impounds a reservoir containing about 90 acre-feet which is used for recreation and flood retardation.
- g. Design and Construction History. The dam was constructed in 1963 by Mr. Sellenriek who was in the land grading and excavation business. Mr. Thorpe, the man who supervised construction of the dam, reported that local S.C.S. personnel assisted in laying out the dam and inspected the core trench. Information from the local S.C.S. office was not available. Mr. Thorpe also reported that material for the dam was good clay borrowed from the valley bottom and adjacent slopes. A core trench was excavated along the centerline. Compaction of the fill was accomplished with the rubber-tired earth moving equipment.
- h. Normal Operating Procedure. There are no controlled outlets for this dam. The reservoir level is controlled by rainfall and runoff, evaporation, and the capacity of the spillways.

1.3 PERTINENT DATA

- a. Drainage Area. 122 acres (0.19 square miles).
- b. Discharge at Damsite.
 - (1) All discharges at the damsite are through a principal spillway consisting of a 12 inch diameter welded steel

pipe spillway with a hooded inlet and a grassed earth channel ungated emergency spillway.

- (2) Estimated maximum flood at damsite -- unknown.
- (3) The principal spillway capacity varies from 0 cfs at elevation 652.0 feet to 14 cfs at the crest of the emergency spillway (elevation 654.0 feet) to 15 cfs at the minimum top of dam (elevation 656.9 feet).
- (4) The emergency spillway capacity varies from 0 cfs at its crest elevation 654.0 feet to 442 cfs at elevation 656.9 feet (minimum top of dam).
- (5) Total spillway capacity at the minimum top of dam is 457 cfs \pm .

c. Elevations (feet above MSL).

- (1) Top of dam - 657.5 \pm (656.9 Minimum)
- (2) Principal spillway crest - 652 \pm
- (3) Emergency spillway crest - 654 \pm
- (4) Streambed at centerline - 625 \pm
- (5) Maximum tailwater - unknown

d. Reservoir. Length (feet) of maximum pool - 1300 \pm

e. Storage (Acre-feet).

- (1) Top of dam - 152 \pm
- (2) Principal spillway crest - 90 \pm

f. Reservoir Surface (Acres).

- (1) Top of dam - 17 \pm
- (2) Principal spillway crest - 10 \pm

g. Dam.

- (1) Type - earthfill
- (2) Length - 730 ft. \pm (measured)
- (3) Height - 34 ft. \pm (measured, maximum)
- (4) Top width - 18 ft. \pm (measured)
- (5) Side slopes.
 - (a) Downstream - 3H on 1V (overall, measured)
some section 4H on 1V
 - (b) Upstream - 3H on 1V (overall, measured)
1H on 1V at high water line

- (6) Zoning - unknown
- (7) Impervious core - unknown
- (8) Cutoff - reported that foundation cutoff bottomed in good clay. Deeper on left end to intercept gravel strata
- (9) Grout curtain - unknown
- (10) Wave protection - none

h. Diversion Channel and Regulating Tunnel. None

i. Spillway.

- (1) Principal
 - (a) Type - uncontrolled, 12 inch diameter welded steel pipe with hooded inlet
 - (b) Crest (invert) elevation - 652 ft.
Outlet - 623.5 ft.
 - (c) Length - 161 ft.±
- (2) Emergency
 - (a) Type - uncontrolled vegetated earth channel cut through left abutment, trapezoidal section, 20 ft.± bottom width with side slopes of 9H on 1V or flatter.
 - (b) Control section - vegetated earth approximately 80 ft. in length
 - (c) Crest elevation - 654 ft.
 - (d) Upstream Channel - open and clean, grassed
 - (e) Downstream Channel - open, well grassed, parallels downstream toe of dam

j. Regulating Outlets. None.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were available for this dam.

2.2 CONSTRUCTION

No construction data were available. It was reported by Mrs. Sellenriek that the dam was constructed in 1963.

2.3 OPERATION

No data were available on spillway operation. It was reported by Mrs. Sellenriek that the reservoir level drops as much as 4 or 5 feet below the principal spillway during drought periods.

2.4 EVALUATION

- a. Availability. No data were available.
- b. Adequacy. The field surveys and visual observation presented herein are considered adequate to support the conclusion of this report. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.
- c. Validity. Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

- a. General. A visual inspection of the Sellenriek Dam was made on June 27, 1979. Engineers from Hoskins-Western-Sonderregger, Inc., Lincoln, Nebraska, making the inspection were: R.S. Decker, Geotechnical; Gordon Jamison, Hydrology; Garold Ulmer, Civil Engineer. Mrs. Sellenriek was present at the dam site. Mr. Everett Thorpe, the man who supervised the construction of the dam, accompanied the inspection team.
- b. Dam.
 - (1) Geology and Soils (Abutment and embankment). Upland soils in the area are CL loessial material probably overlying cherty limestone. Valley slopes (abutments) are silty clay (CL) with cherty gravel. No limestone bedrock was exposed at the site or in the immediate area. Auger holes on the embankment produced plastic CL-CH soil to depths of 2 to 2.5 feet.
 - (2) Upstream Slope. The upstream slope is well vegetated with adapted grasses. A few small trees and shrubs are growing along the water line. Considerable erosion of the face has occurred at or just above the normal pool elevation (elev. 652-653). A few muskrat burrows were noted along the water line. No slumps or other deformations were noted on the upstream slope.
 - (3) Crest. The crest is plated with cherty limestone gravel and serves as a roadway. The crest also supports a fair cover of adapted grasses. No cracks or indications of deformation were noted on the crest. The crest is remarkably level for a non-engineered dam with one small swag at elevation 657 ft. and the remainder of the crest at 657.5 ft.
 - (4) Downstream Slope. The downstream slope is very well vegetated with adapted grasses. A few small cedar trees were observed growing on the slope. A definite bulge is apparent in the downstream slope from about station 4 + 00 to near the right (east) end of the dam. The man who supervised construction of the dam (Mr. Everett Thorpe) reported that the bulge was caused by overfilling that section due to a mix-up in slope staking during construction. No cracks, rodent holes or signs of abnormal deformation (other than the constructed overfill) were noted on the slope or along the toe of the dam. There was no indication of emergence of the

phreatic line on the slope nor any sign of seepage along the toe or in the stream channel downstream from the pipe outlet. Soils in the downstream slope are good CL.

- (5) Miscellaneous. The good vegetative cover and the plastic materials apparent in the embankment indicate that this structure could withstand significant overtopping without serious damage. There was no indication or evidence of overtopping.

c. Appurtenant Structures.

- (1) The principal spillway is uncontrolled and consists of a 12 inch welded steel pipe with hooded inlet passing through the dam. The inlet is covered with a wire mesh trash guard which was open. No deterioration of the steel pipe was noted. The scour hole and surrounding area at the outlet end is overgrown with brambles and brush. The reservoir level was 0.7 ft. below the inlet of the spillway at the time of inspection. The bottom of the outlet scour hole and downstream channel were dry when inspected.
- (2) The emergency spillway is uncontrolled and consists of a vegetated channel cut through cherty clay on the left abutment. The approach channel is clear and open. The exit channel is clear and open and outlets downstream and roughly parallel with the downstream toe of the dam. All of the emergency spillway is very well vegetated and free of erosion. There was no indication of flow through the emergency spillway nor any evidence of overtopping of the dam. Discharge through the spillway should not endanger the dam.
- (3) Drawdown Facilities. No drawdown facilities exist for this structure.

d. Reservoir Area. The area surrounding the reservoir appears to be well grassed. Some erosion was noted around the shoreline but nothing significant. A gravel armored beaching slope has developed in portions of the shoreline. The reservoir water was clear.

e. Downstream Channel. The channel downstream from the principal spillway is armor plated with cherty limestone gravel and appears to be stable. It is overgrown with trees and brush.

3.2 EVALUATION

There does not appear to be any serious potential of failure of this dam. Sideslopes and materials in the dam should provide adequate safety against shear failure. No sign of seepage was noted in the downstream area. Overtopping should not seriously impair the safety of the structure. The minor deficiencies noted (few trees on backslope and wave erosion on upslope) do not appear to require immediate remedial action. However, measures should be initiated in the near future to curtail the activities of the muskrats on the embankment.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam. The pool level is controlled by rainfall, evaporation, and the capacity of the uncontrolled spillways.

4.2 MAINTENANCE OF DAM

Maintenance of this dam appears to be generally good. The muskrats should be eliminated and measures taken to remove the trees from the embankment slopes and to protect the upstream face from continued erosion.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

Upon checking with the owner, we are unaware of any warning system in effect for this dam.

4.5 EVALUATION

There does not appear to be any serious potential of failure of this structure.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

- a. Design Data. No design data were found for this dam. All computations are based on field inspection and surveys by the consultant. The plan, profiles, and cross sections from the survey are attached in Appendix C.
- b. Experience Data. The drainage area, reservoir surface area, and elevation-storage data were developed from the USGS Disson, Missouri 7 1/2 minute topographic quadrangle map. The hydraulic computations for the spillway and dam overtopping discharge ratings were based on data collected in the field at the time of the field inspection.
- c. Visual Observations.
 - (1) The spillway pipe appeared to be in good condition. A trash rack was located on the hooded inlet and was clear of debris.
 - (2) The emergency spillway is located in the left abutment of the dam. Spillway releases should not endanger the integrity of the dam.
 - (3) No drawdown facilities are available to evacuate the pool.
- d. Overtopping Potential. The spillways are too small to pass 50% of the probable maximum flood without overtopping. The spillways will pass 40% of the PMF without overtopping. The 100-year (1 percent) peak outflow discharge is approximately 5% of the spillway capacity. This dam could withstand significant overtopping without serious damage.

The results of the routings through the dam are tabulated in regards to the following conditions.

Frequency	Peak Inflow Discharge cfs	Peak Outflow Discharge cfs	Maximum Pool Elevation	Freeboard Top of Dam Min. Elev. 656.9	Time Dam Overtopping Hr.
100 Yr.	470	20	654.3	+2.6	0
1/2 PMF	1100	580	657.2	-0.3	1±
PMF	2200	2000	658.0	-1.1	2±
0.4 PMF	890	400	656.7	+0.2	0

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and a small size. Therefore, the 1/2 PMF to the PMF is the test for the adequacy of the dam and its spillway.

The estimated damage zone is described in Paragraph 1.2d in this report.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

- a. Visual Observation. The dam appears to be structurally stable. The embankment slopes should provide adequate safety factors against shear failures for a dam of this size. There were no seeps, slides or abnormal deformations in the embankment or abutments. Additional studies would be required to determine the effect of overtopping on structural stability. However, it appears that the safety of the dam would not be impaired by significant overtopping.
- b. Design and Construction Data. No design or construction data were available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.
- c. Operating Records. There are no controlled operating facilities for this dam.
- d. Post Construction Changes. The inspection team is not aware of any post-construction changes on this dam.
- e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of the magnitude predicted in this area is not expected to cause structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

- a. Safety. This dam appears to have only a slight potential of failure. Using the approximate data available for analysis, the dam will be overtopped 0.3 foot for a period of 1+ hour by one-half the Probable Maximum Flood. The effect of such overtopping on the structural or erosional stability of the dam is not known, but is believed to be minimal. Seepage and stability analyses were unavailable and is considered a deficiency.
- b. Adequacy of Information. Due to the lack of engineering data, the conclusions in this report are based upon performance history and visual observations. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made as a matter of record.
- c. Urgency. The item recommended in paragraph 7.2a should be pursued on a high priority basis. The curtailment of muskrat activities on the dam should be done in the near future.
- d. Necessity for Phase II. Phase II investigation is not considered necessary.
- e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of this magnitude is not expected to be hazardous to this dam.

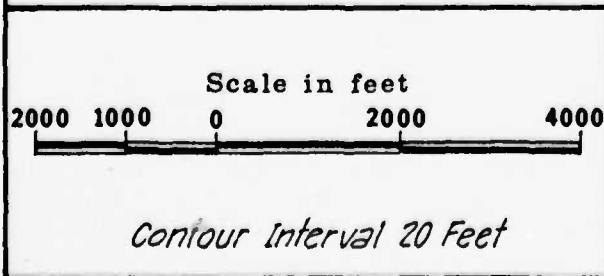
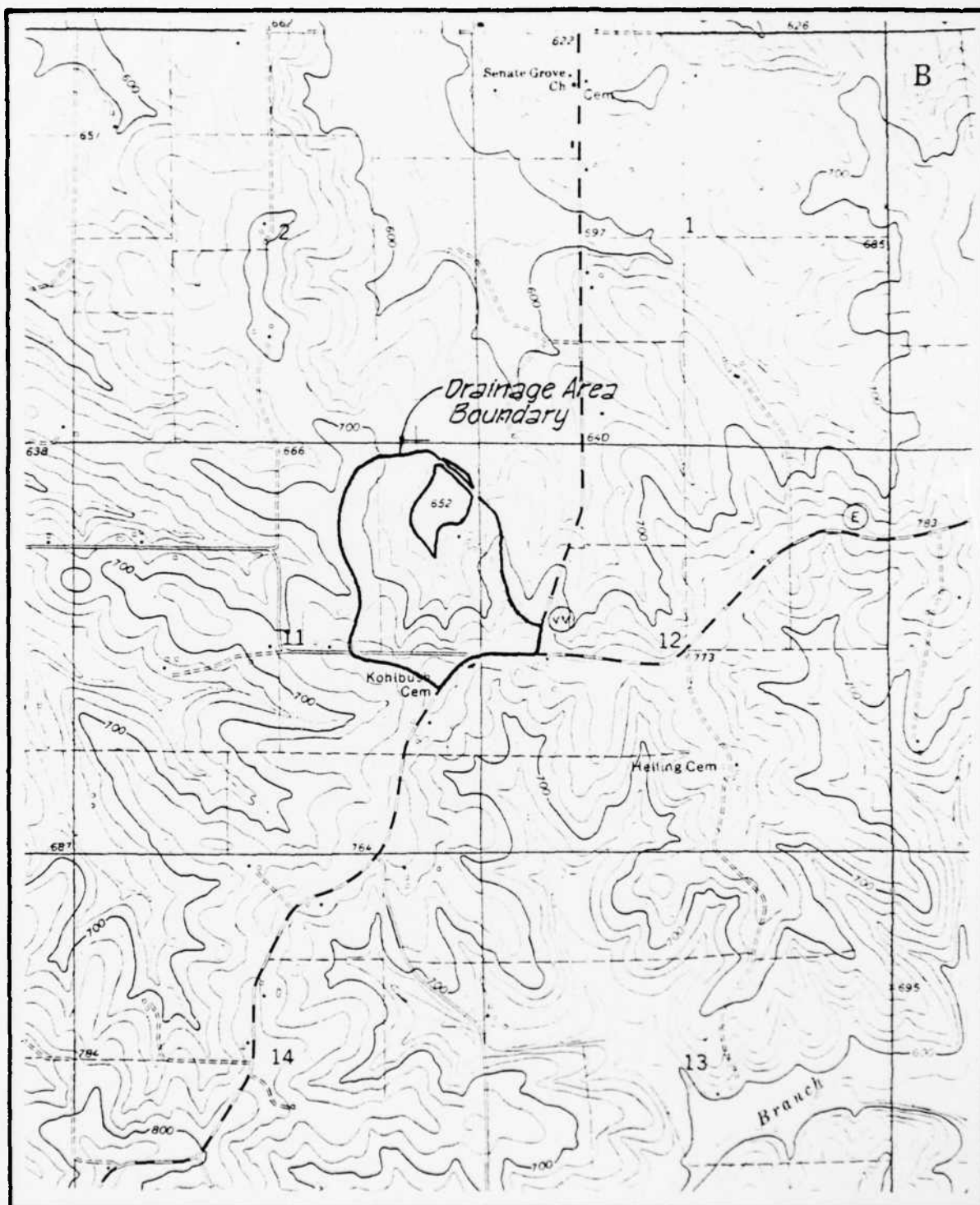
7.2 REMEDIAL MEASURES

- a. Alternatives. Additional information should be obtained on the effects of overtopping and on the topographic characteristics of the reservoir area to determine the increase in the height of dam or the size of the spillway that is necessary to pass one half the Probable Maximum Flood without overtopping the dam. The services of an engineer experienced in the design of dams should be obtained to evaluate the present reservoir storage capacity, to provide seepage, erosional, and stability analyses of the present dam, and to design protective measures, if required.

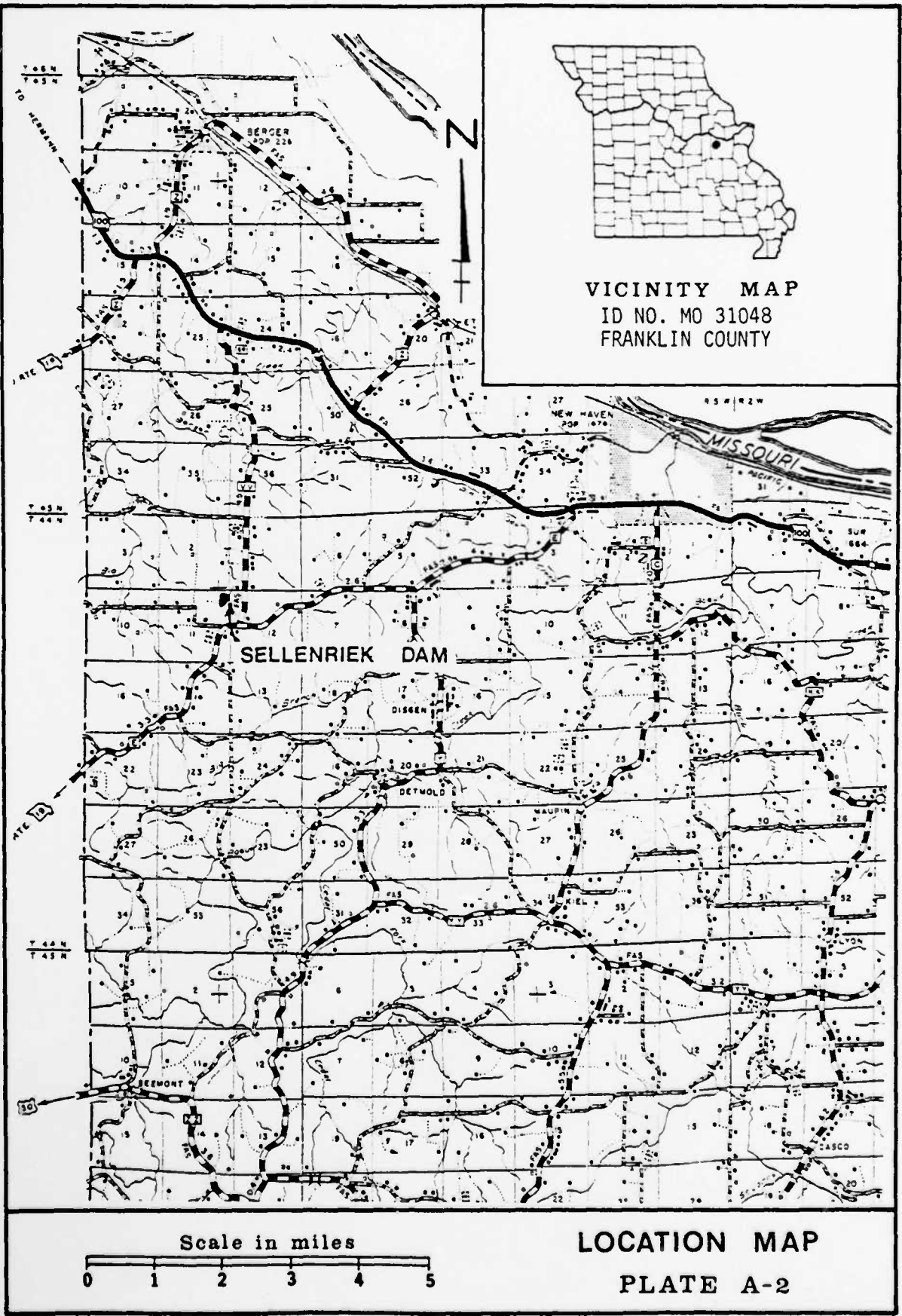
b. O & M Procedures

- (1) The activities of the muskrats on the embankment should be curtailed in the near future.
- (2) Trees should be removed from the embankment slopes and measures taken to prevent their recurrence and to control the erosion on the upstream face of the dam.
- (3) A program of periodic inspection and maintenance implementation should be initiated to control these minor deficiencies.

APPENDIX A
MAPS



VICINITY TOPOGRAPHY
SELLENRIEK DAM
 FRANKLIN COUNTY, MISSOURI
 MO. 31048
PLATE A-1



VICINITY MAP
ID NO. MO 31048
FRANKLIN COUNTY

Scale in miles



LOCATION MAP
PLATE A-2

APPENDIX B
PHOTOGRAPHS

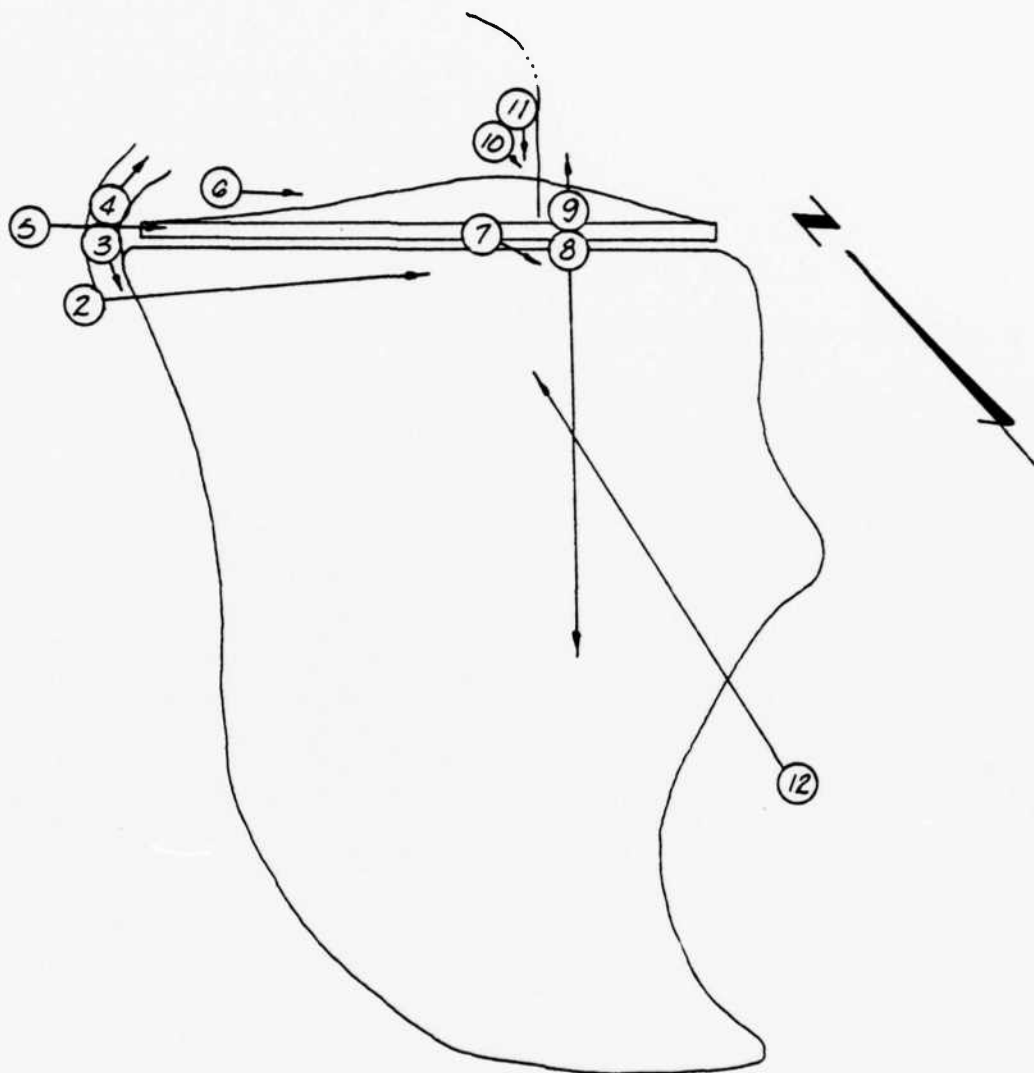


PHOTO INDEX

SELLENRIEK DAM

FRANKLIN COUNTY, MISSOURI

MO. 31048

PLATE R-1



PHOTO NO. 2 - UPSTREAM SLOPE FROM LEFT ABUTMENT



PHOTO NO. 3 - LOOKING UPSTREAM IN EMERGENCY SPILLWAY



PHOTO NO. 4 - LOOKING DOWNSTREAM IN EMERGENCY SPILLWAY



PHOTO NO. 5 - CREST OF DAM FROM LEFT ABUTMENT



PHOTO NO. 6 - DOWNSTREAM SLOPE FROM LEFT

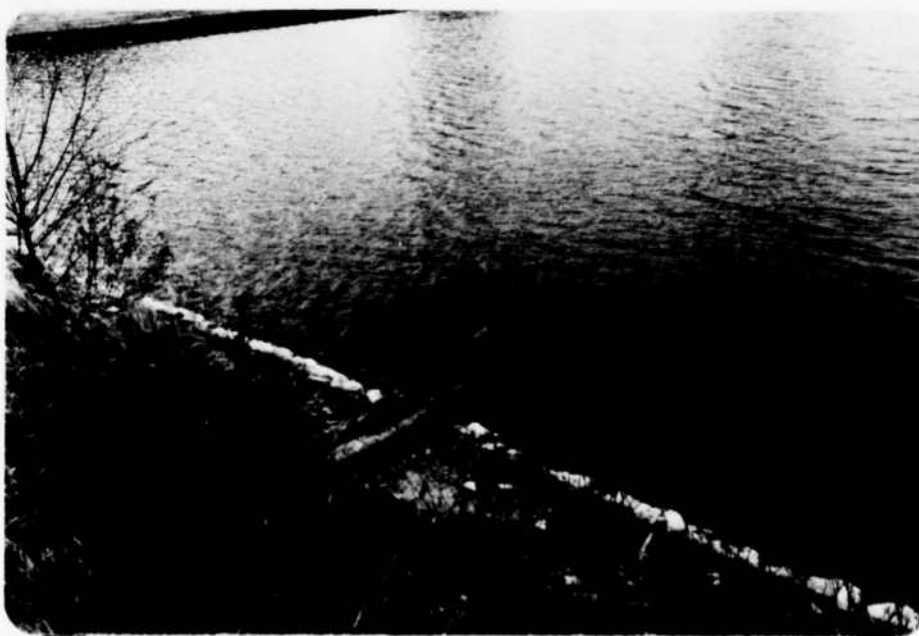


PHOTO NO. 7 - INLET OF PIPE SPILLWAY



PHOTO NO. 8 - LOOKING UPSTREAM ACROSS LAKE



PHOTO NO. 9 - LOOKING DOWNSTREAM FROM STA. 6 + 75



PHOTO NO. 10 - OUTLET OF PIPE SPILLWAY

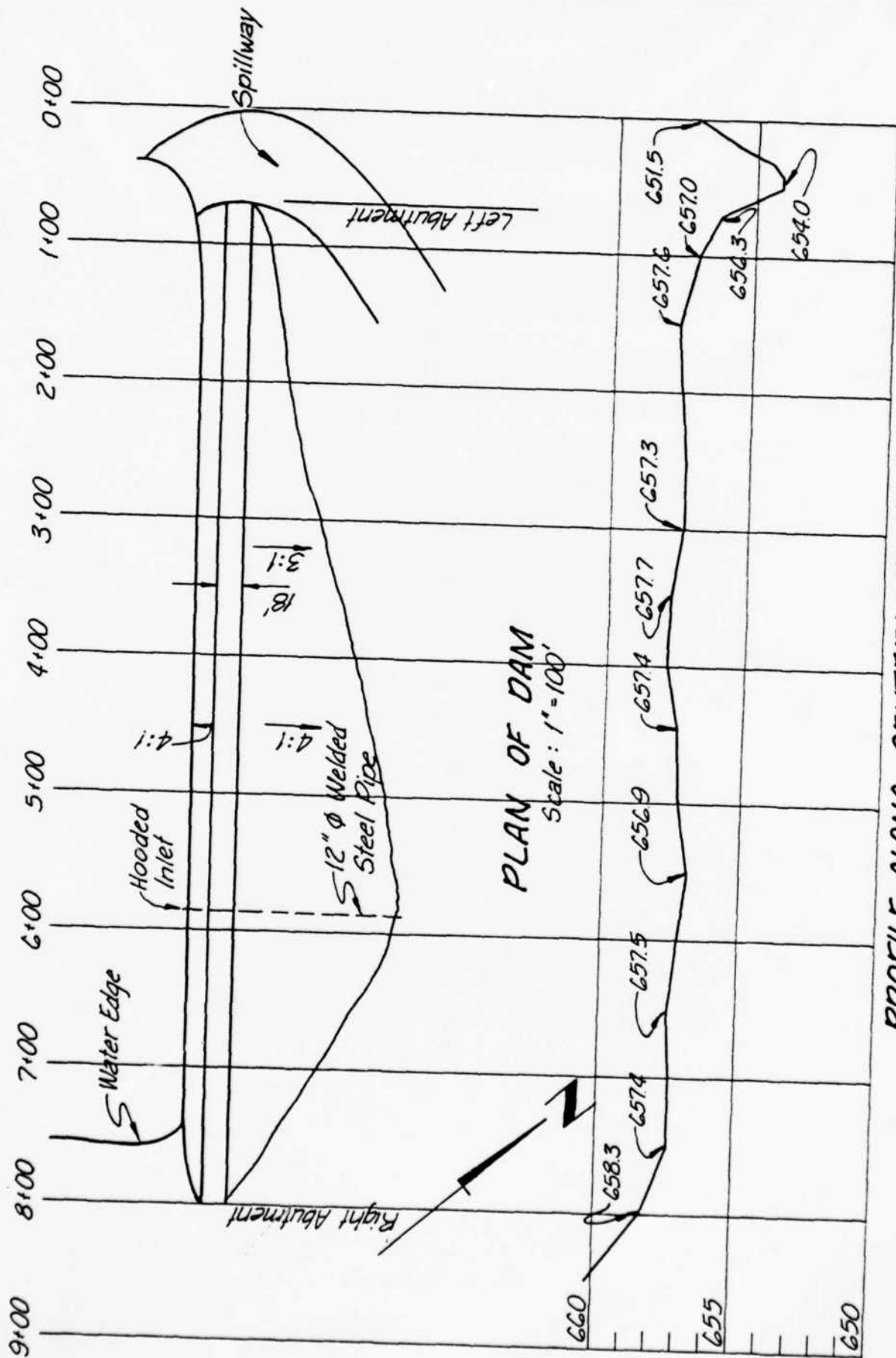


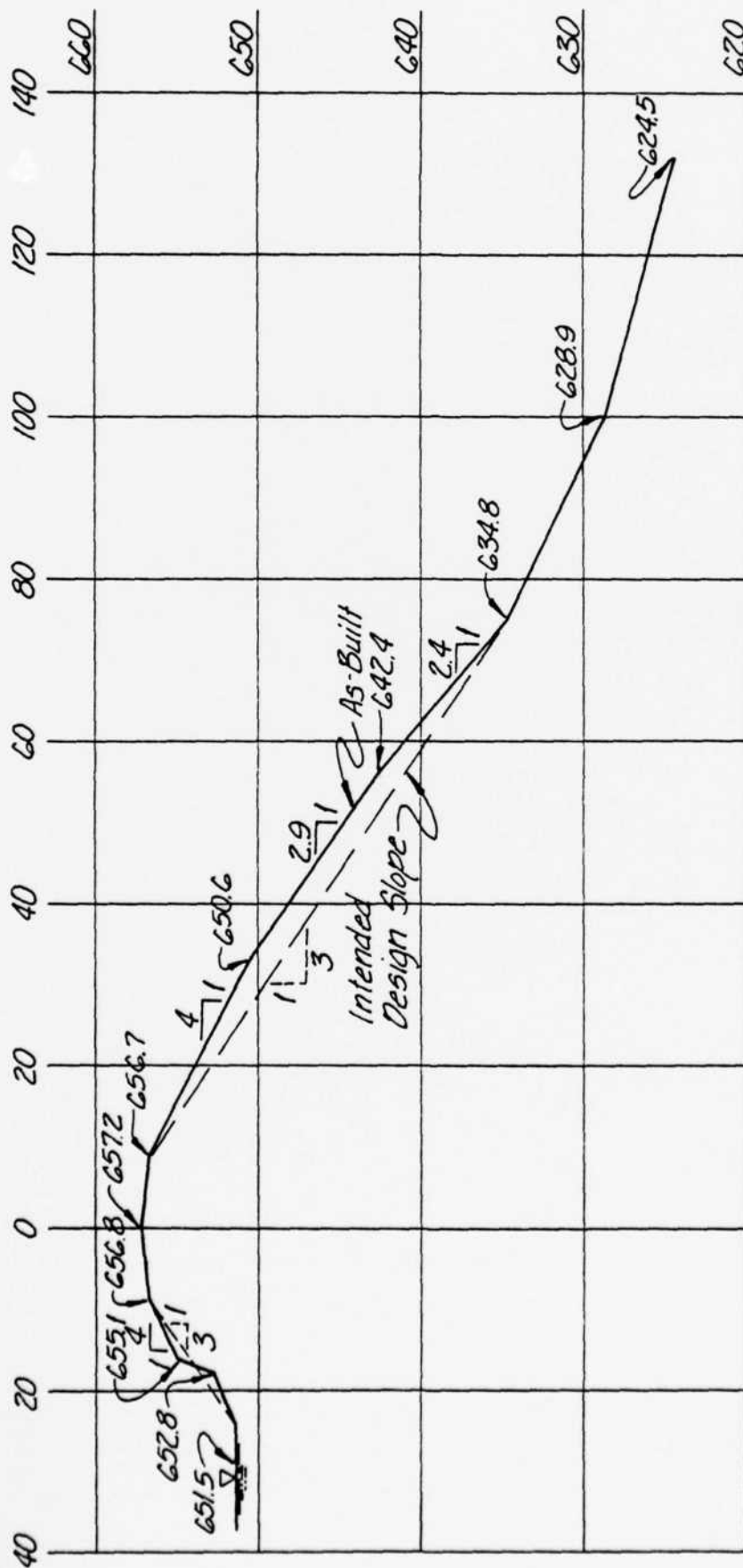
PHOTO NO. 11 - OUTLET OF PIPE SPILLWAY



PHOTO NO. 12 - OVERVIEW TAKEN FROM HIGH ON RIGHT SIDE.
DAM IN CENTER

APPENDIX C
PROJECT PLATES

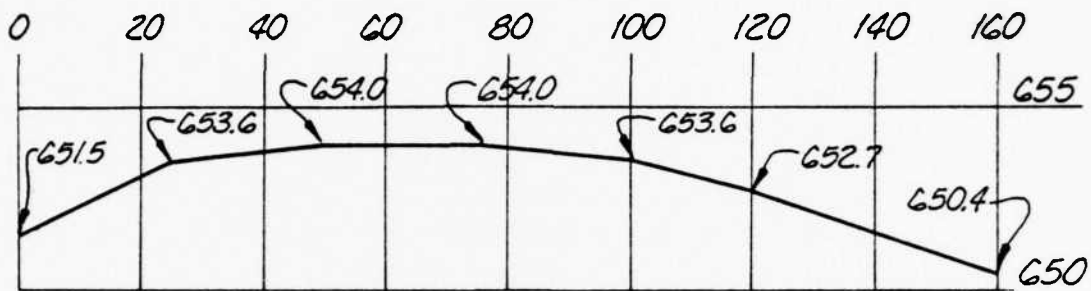




SECTION @ STA. 6+00

Scale: 1" = 20' H.

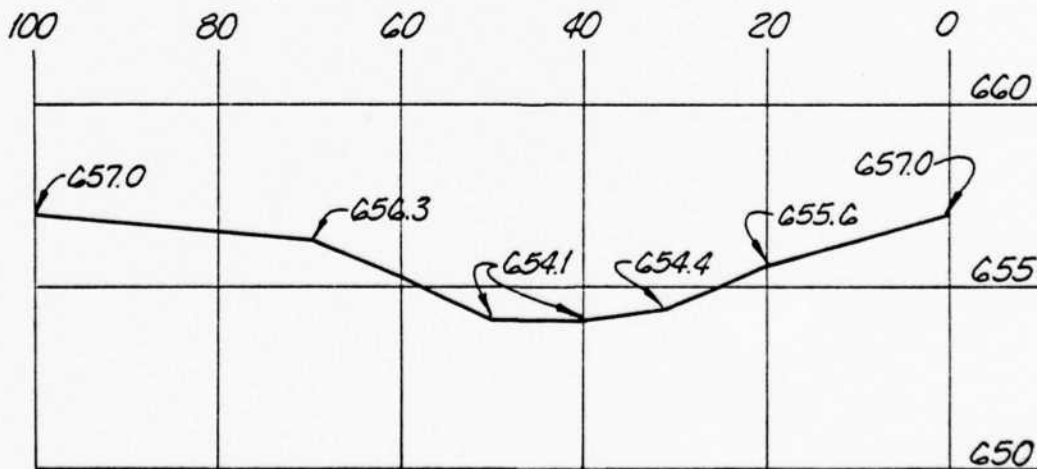
1" = 10' V.



♂ PROFILE OF SPILLWAY

Scale : 1" = 30' H.

1" = 5' V.



SPILLWAY SECTION (♂ of DAM)

Scale : 1" = 20' H.

1" = 5' V.

APPENDIX D
HYDRAULIC AND HYDROLOGIC DATA

HYDROLOGIC COMPUTATIONS

1. The SCS dimensionless unit hydrograph and the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Corps of Engineers, Davis, California, were used to develop the inflow hydrographs (See Appendix D).
 - a. Twenty-four hour, 100-year rainfall for the dam location were taken from the data for the rainfall station at Sullivan, MO. as supplied by the St. Louis District Corps of Engineers per their letter dated 6 March 1979. The twenty-four hour probable maximum precipitation was taken from the curves of the Hydrometeorological Report No. 33 and current Corps of Engineers and St. Louis policy and guidance for hydraulics and hydrology.
 - b. Drainage area = 0.19 square miles (122 acres).
 - c. Time of concentration of runoff = 12 minutes (computed from Kirpich formula).
 - d. The antecedent storm conditions for the probable maximum precipitation were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMC III). The antecedent storm conditions for the 100-year precipitation were an average of the conditions which have preceded the occurrence of the maximum annual flood on numerous watersheds (SCS AMC II). The initial pool elevation was assumed at the invert of the principal spillway.
 - e. The total twenty-four hour storm duration losses for the 100-year storm were 3.33 inches. The total losses for the PMF storm were 1.88 inches. These data are based on SCS runoff curve No. 86 and 71 for antecedent moisture conditions SCS AMC III and AMC II respectively. The watershed is composed of SCS soil groups B, C, and D (Peridge-Gasconade-Gross-Union) with 50% of watershed being of soil group B (Peridge). Land usage consisted primary of cultivated land with some of the watershed in woods and pasture.
 - f. Average soil loss rates = 0.08 inch per hour approximately (for PMF storm, AMC III).
2. The combined discharge rating consisted of three components: the flow through the principal spillway, the flow through the emergency spillway and the flow going over the top of the dam.

a. The principal spillway rating was developed by using weir flow and the full conduit flow equation:

(1) The weir flows were developed using Table 21-37- "Upstream Head and Discharge Ratios for Pipes Flowing Partly Full" from V. T. Chow's Handbook of Applied Hydrology (New York: McGraw-Hill Book Company, 1964).

(2) Full Flow Equation.

$$Q = a \sqrt{\frac{2gH}{1 + K_e + K_b + K_p L}}$$

where a = cross-sectional area of pipe, ft² = 0.785

H = total head, ft.

K_e = coefficient for entrance loss = 0.5

K_b = coefficient for bend loss = 0.024

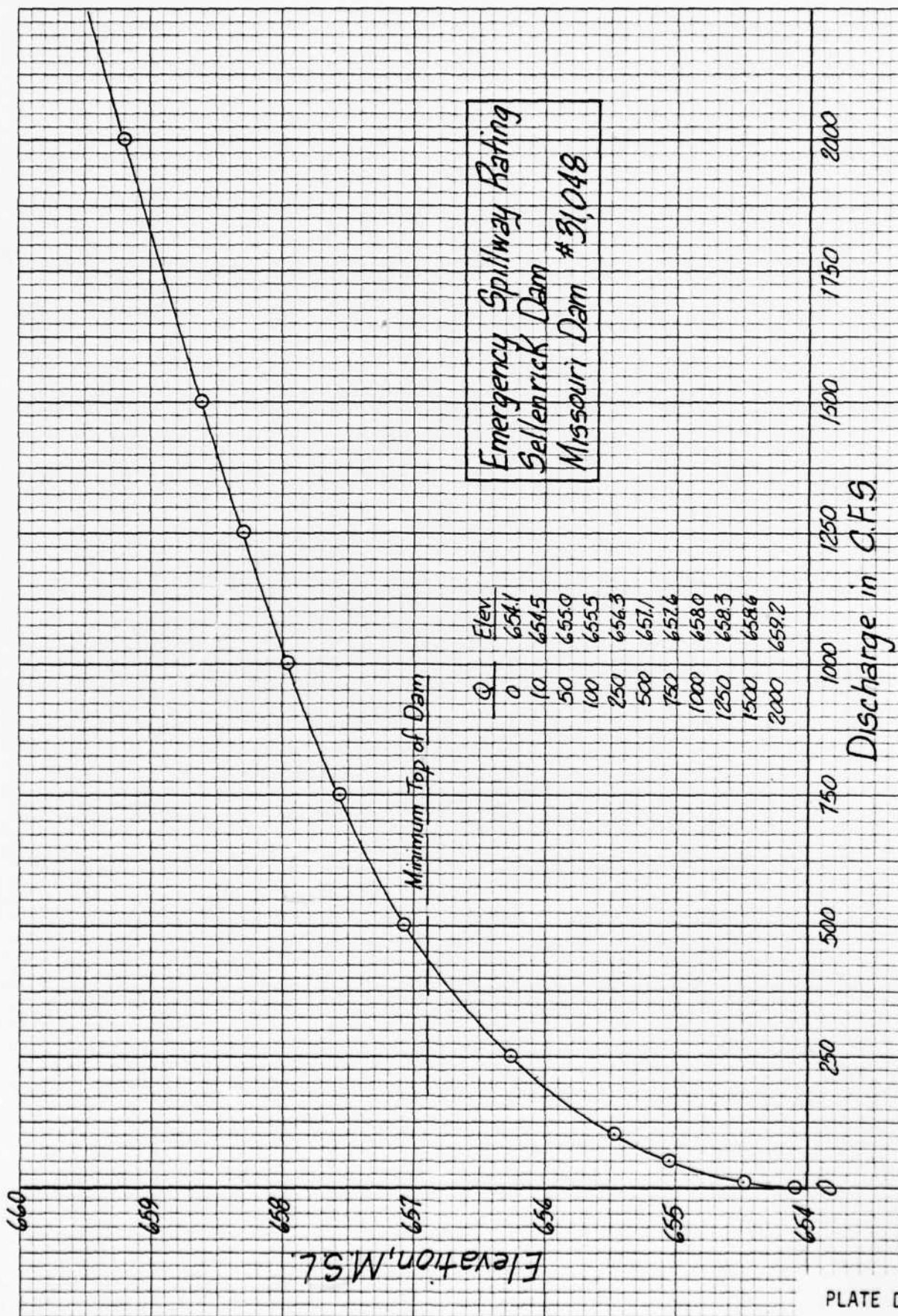
K_p = coefficient for pipe friction loss = 0.02673

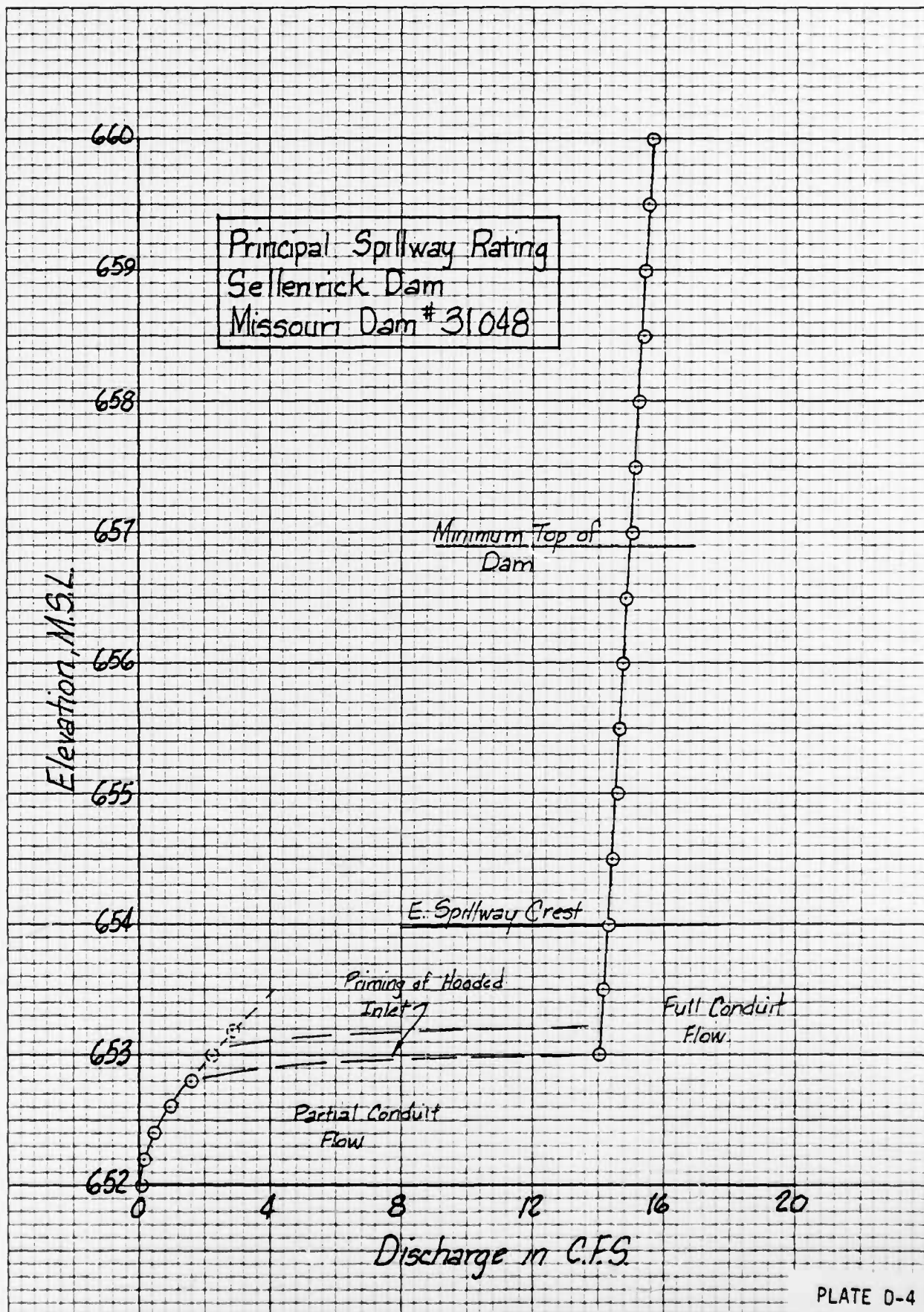
L = length of pipe, ft. = 161

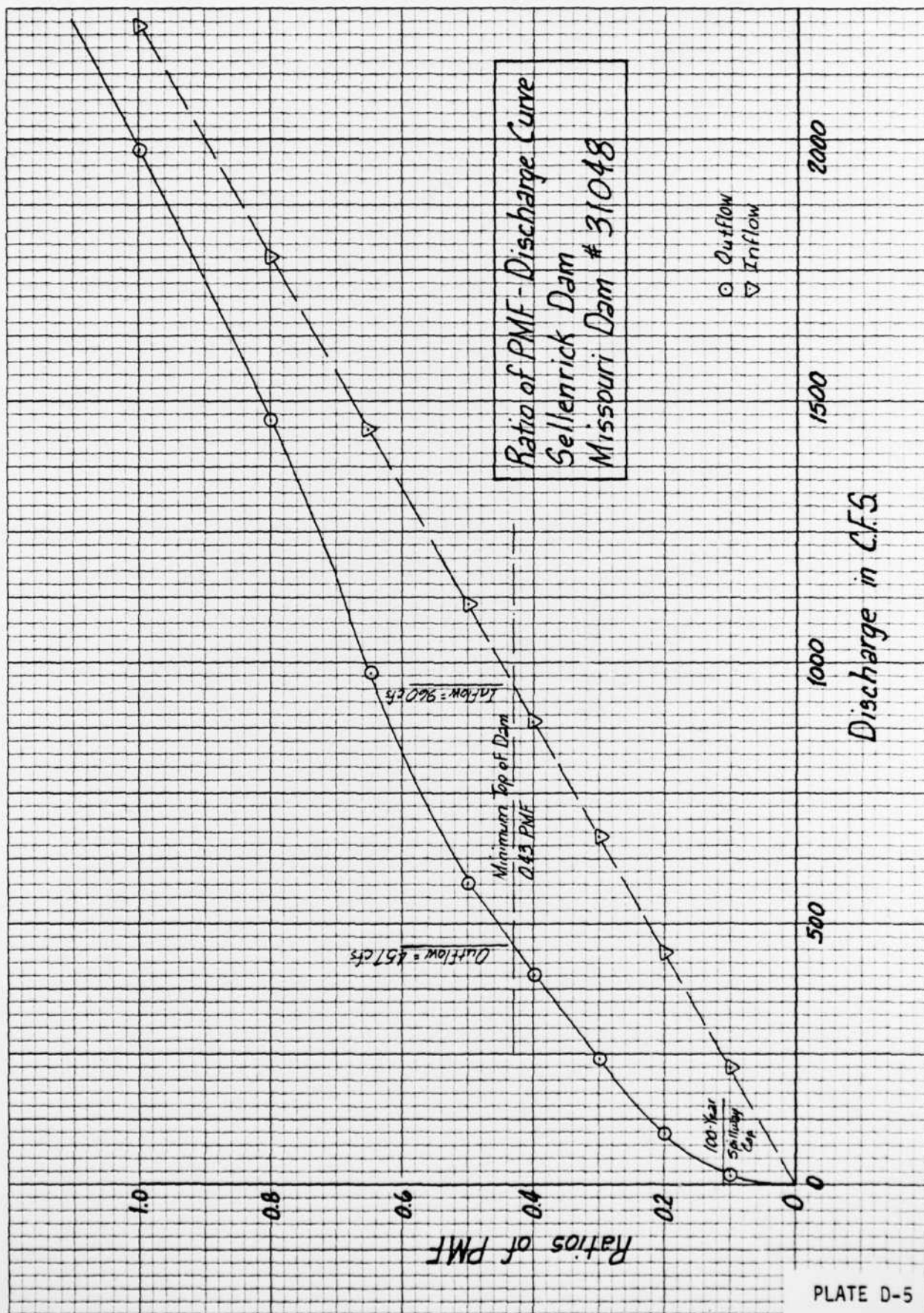
b. The emergency spillway ratings were developed using the Corps of Engineers Surface Water Profile HEC-2 computer program.

c. The flows over the dam were developed using the dam overtopping analysis (Flow over non-level dam crest) within the HEC-1 (Dam Safety Version) program.

3. Floods were routed through the reservoir using the HEC-1 (Dam Safety Version) program to determine the capabilities of the spillway and dam embankment crest. The output and plotted hydrographs are attached as Appendix D.







 FLOOD HYDROGRAPH PACKAGE (HEC-11)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

RUN DATE= 79/07/25.
 TIME= 15.44.30.

ANALYSIS OF DAM DVERTOPPING USING RATIOS OF PMF
 HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF SELLENRICK DAM 31048
 RATIOS OF PMF ROUTED THRU THE RESERVOIR

JOB SPECIFICATION

NO	NHR	NHIN	IOAY	IHR	IMIN	HEIRC	IMLT	IPRT	NSTAN
288	0	5	0	0	0	0	0	3	0
JOPER= 5									
LROPT TRACE									
0									

MULTI-PLAN ANALYSES TO BE PERFORMED

RATIOS= .10 .20 .30 .40 .50 .65 .80 1.00
 NPLAN= 1 NRATIO= 8 LATIO= 1

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDROGRAPH TO 31048 RESERVOIR

ISTAQ	ICOMP	TECON	ITAPE	JPLT	JPKT	INAME	ISTAGE	TAUTO
000001	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.19	0.00	.19	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	25.30	102.00	121.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STKR	OLTKR	RTIOL	ERAIN	STKRS	RTIOL	STRTL	CHSTL	ALSHX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-86.00	0.00	0.00

CURVE NO = -86.00 WEIKNSS = -1.00 EFFECT CN = 86.00

UNIT HYDROGRAPH DATA

TC= 0.00 LAG= .17

RECESSION DATA

SIRYQ= 0.00 QRCSN= -.01 RTIOR= 1.00

UNIT HYDROGRAPH 12 END OF PERIOD ORIGINATES. TC= 0.00 HOURS, LAG= .17 VOL= 1.00
 132. 399. 410. 257. 129. 69. 36. 19. 10. 5.
 1.

END-OF-PERIOD FLOW

Case Documents, Inc. 07

•DVF•

STATION000002

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

	0.	200.	400.	600.	800.	1000.	1200.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
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0.05																	
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551																	
4.40																	
561																	

4.45 571
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5.00 601
5.05 611
5.10 621
5.15 631
5.20 641
5.25 651
5.30 661
5.35 671
5.40 681
5.45 691
5.50 701
5.55 711
6.00 721
6.05 731
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6.15 7501
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6.30 7801
6.35 7901
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6.55 830
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7.15 870
7.20 880
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7.30 900
7.35 910
7.40 920
7.45 930
7.50 940
7.55 950
8.00 960
8.05 970
8.10 980
8.15 990
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8.40 1040
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9.35 115.01
9.40 116.01
9.45 117.01
9.50 118.01

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14-35175-01
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14-55179-01
15-00180-01

This image shows a full page of dot grid paper. The grid consists of small, evenly spaced black dots arranged in horizontal and vertical rows across the entire page. There are no margins, text, or other markings present.

PEAK FLOW AND STORAGE TEND (IF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS

FLows IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)

AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS							
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8
				.10	.20	.30	.40	.50	.65	.80	1.00
HYDROGRAPH AT	000001	.19	1	222.	444.	665.	887.	1109.	1442.	1774.	2218.
	(	.49)	(	6.28)	12.56)	18.84)	25.12)	31.40)	40.82)	50.24)	62.80)
ROUTED TO	000002	.19	1	18.	97.	239.	400.	576.	976.	1462.	1976.
	(	.49)	(	.52)	2.75)	6.76)	11.32)	16.31)	27.63)	41.39)	55.94)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

ELEVATION STORAGE	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
OUTFLOW	652.00	652.00	656.90
	90.	90.	152.
	0.	0.	457.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	654.20	0.00	115.	18.	0.00	18.25	0.00
.20	655.30	0.00	129.	97.	0.00	16.42	0.00
.30	656.15	0.00	141.	239.	0.00	16.08	0.00
.40	656.73	0.00	150.	400.	0.00	16.00	0.00
.50	657.16	.26	157.	576.	.50	16.00	0.00
.65	657.57	.67	163.	976.	.92	15.92	0.00
.80	657.80	.90	167.	1462.	1.25	15.83	0.00
1.00	657.99	1.09	170.	1976.	1.92	15.83	0.00

**DAT
FILM**

PEAK OUTFLOW IS

Data Documents Inc. 02

PLATE D-10

•OVF•

0. 20
05 11
10 21
15 31
20 41
25 51
30 61
35 71
40 81
45 91
50 101
55 111
60 121
65 131
70 141
75 151
80 161
85 171
90 181
95 191
100 201
105 211
110 221
115 231
120 241
125 251
130 261
135 271
140 281
145 291
150 301
155 311
160 321
165 331
170 341
175 351
180 361
185 371
190 381
195 391
200 401
205 411
210 421
215 431
220 441
225 451
230 461
235 471
240 481
245 491
250 501
255 511
260 521
265 531
270 541
275 551
280 561

DATA DOCUMENTS 16-12

PLATE D-11

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8.50 10601
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9.05 10901
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9.50 11801

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PLATE D-12

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Data Communications, Inc. 82

PLATE D-13

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17.25209.	0.
17.30210.	0.
17.35211.	0.
17.40212.	0.
17.45213.	0.
17.50214.	0.
17.55215.	0.
18.00216.	0.
18.05217.	0.
18.10218.	0.
18.15219.	0.
18.20220.	0.
18.25221.	0.
18.30222.	0.
18.35223.	0.
18.40224.	0.
18.45225.	0.
18.50226.	0.
18.55227.	0.
19.00228.	0.
19.05229.	0.
19.10230.	0.
19.15231.	0.
19.20232.	0.
19.25233.	0.
19.30234.	0.
19.35235.	0.
19.40236.	0.
19.45237.	0.
19.50238.	0.
19.55239.	0.
20.00240.	0.
20.05241.	0.
20.10242.	0.

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